"Japanese-Style" Relationships in the Early Years of the US Auto Industry

by

Susan R. Helper
David Hochfelder
“Japanese-Style” Supplier Relationships in the
American Auto Industry, 1895-1920

Susan Helper and David Hochfelder¹
Department of Economics
Case Western Reserve University
Cleveland, OH 44106
U.S.A.

In recent years, US automakers have moved toward closer relationships with
their suppliers. In particular, Ford and Chrysler have moved away from historically
adversarial dealings with suppliers toward relationships which are long-term and are
characterized by rich flows of information for joint projects such as product
development and technical assistance.

This transformation has been seen by the popular press and by the managers
making this change as an imitation of the Japanese, and as a move away from
traditional American practice. However, evidence indicates that many of the features of
these so-called “Japanese-style” customer/supplier relationships were present in the
US auto industry before 1920.

This paper traces the evolution of supplier relations in three successive stages:
fast market growth and segmentation in the auto industry before 1908, mass production
and vertical integration between 1909 and 1920, and consolidation from early twenties
to the late thirties. We argue that suppliers enjoyed close and cooperative ties with
automakers before 1908, while their relationships grew increasingly adversarial
between 1909 and 1920. This transitional period proved decisive in changing supplier
relations, and subsequent industry consolidation cemented these patterns into place for
decades to come.

The US auto industry turned out just over 60,000 vehicles in 1908; by 1920
output topped the two million mark.² This remarkable growth paralleled the Japanese
vehicle industry in the 1950s and 1960s, when production leaped from 68,000 in 1955 to over seven million in 1973. Both US and Japanese automakers in these periods acted to protect their supplier networks to ensure low prices and continued access to sorely-needed parts. But they did so in different ways. American automakers after 1909 moved away from cooperative ties, choosing a combination of vertical integration and arms-length relationships with outside suppliers. On the other hand, Japanese automakers in the 1950s and 1960s “quasi-internalized” their suppliers, drawing them into their keiretsu groups in which specialized parts firms enjoyed semi-exclusive, long-term commitments from the parent assemblers.

This essay concludes with an explanation for the divergent paths taken by the American and Japanese industries. By doing so we aim to illuminate the differences between business groups in the two countries and to add to the growing literature on comparative business structures.

Rising Demand and Market Differentiation--The U.S. Auto Industry to 1908

Pioneering American builders turned out about three hundred automobiles between 1886 and 1898, nearly all of an experimental nature. Just before the turn of the century, demand for automobiles grew and makers increasingly standardized their designs and outsourced more parts. Suppliers with experience in mass-producing vehicle components sought to enter this expanding new market. Bicycle parts makers offered items like bolts and small forgings, and carriage suppliers modified their lamps and bearings to fit the automobile. These companies began marketing to the new industry in 1898 and 1899. In those years, many of the pioneering parts suppliers sprang up in the Northeast, the first center of the American automobile industry. These firms included Boston's Gray & Davis Co., which made automobile lamps starting in
1897; Utica’s Weston-Mott Co., which shifted from bicycle wheels to motor car wheels in 1898; and Newark’s Hyatt Roller Bearing Co., which sold its first automobile bearings to the pioneering firm of Haynes-Apperson in 1899. Locomobile of Newton, MA, an industry leader in steam vehicles, moved to secure its sources of supply as early as 1899. At the end of that year the firm expanded into the plant of a failed competitor and bought out its supplier of drop forgings. It also contracted with a maker of steam boiler regulators to “furnish engines to the full of the capacity of that concern. All of these plants are being operated at full tilt and...the Newton factory would eventually be used for assembling only.”

Locomobile’s early efforts to secure its sources of supply showed the growing importance of a supplier base for the new industry as it moved from experimentation to commercial production. As it did, makers found it more economical to turn to outside suppliers for many parts they formerly made themselves. Over the next several years, the parts industry grew in sophistication and supplied automakers with everything from bolts to complete chassis. Seventeen automakers (5 making gasoline-powered cars, 4 turning out steam-powered machines, and 8 producing electric vehicles) exhibited at the first national auto show held in Chicago in early 1901, but 24 parts makers and 4 parts jobbers displayed everything from headlights and batteries to transmissions and complete running gears.

Demand for automobiles increased steadily after the turn of the century. About two dozen makers produced just over 4000 automobiles in 1900. In 1908, about 150 companies sold 65,000 passenger cars, ranging in price from $650 to over $5000. Over the course of these nine years the automobile market mushroomed in volume and number of manufacturers and segmented according to price.
The development of the low-priced runabout, a rugged and dependable car selling for hundreds, instead of thousands, of dollars, placed the automobile within reach of many more consumers. When Henry Ford announced his plans for his Model N runabout, forerunner to the Model T, in the trade press in early 1906, he was one of the few makers who foresaw the enormous demand for a "light, low-priced car with an up-to-date engine of ample horsepower, ... one where a chauffeur will not be absolutely necessary either as a driver or because of his mechanical skill."¹⁰ Ford was hugely successful and the Model T remained the best-selling car in the world until the mid 1920s.

Few car builders agreed with Ford. Most held that "prices should be maintained" in order to take full advantage of the period's exploding demand, and they regarded the production of a low-priced car for the mass market as "unjustifiable and suicidal," as Ford characterized their views.¹¹ As Figure 1 shows, in 1903 about 75% of the cars on the market sold for under $1375, with about 45% in the $875 to $1375 range. As demand increased after 1903, many builders abandoned the low-price segment of the market and targeted their products to those who could afford a distinctive and luxurious car. By 1907, sales of cars costing under $1375 plummeted to less than 40% of the market; conversely, builders such as Winton who marketed exclusively to the wealthy and charged over $2775 for their vehicles accounted for about a quarter of sales.¹² By way of comparison, the typical non-farm laborer of 1904 brought home $540 for the year, and the average physician of this time earned between $1000 and $1500.¹³ For all except the well-to-do, an automobile represented a large expenditure relative to income.

This market structure helped to shape relations between makers and suppliers. Most builders of low and mid-priced vehicles assembled their products out of equipment bought from suppliers, while builders in the luxury market fabricated most of
Figure 1. Percentage of unit volume versus price class for 1903, 1907, and 1911. Taken from Epstein, p. 100.
their components themselves. A typical mid-priced car contained an outsourced motor, transmission, carburetor, electrical system, and axles. Many manufacturers, like the short-lived Daisy Automobile Co. of Flint, Michigan, merely placed a body onto an outsourced chassis. In the summer of 1902 that firm announced its plans to build its first one hundred cars, "a standard machine in all respects." The firm's founders resolved "not to waste time or money in experimental work...While the body design will be somewhat original in many respects, the remainder of the parts will be secured from makers of standard parts, all of which can be assembled without delay."\footnote{14} Even Henry Ford began business that following year in much the same fashion, with only $28,000 in capital. The Dodge brothers, owners of a local machine shop, supplied him with completed chasses to which he merely added bodies, wheels, and tires.\footnote{15} Ford, unlike Daisy, designed much of the chassis which the Dodies fabricated for him.

The Daisy Automobile Co., Henry Ford, and dozens of other low- and mid-priced builders thus relied heavily on an expanding supplier base during their critical early years. Assemblers like Daisy who did not want to expend much engineering effort bought major components from suppliers like the Lindsay Automobile Parts Co. That Indianapolis supplier of transmissions, motors, and running gears\footnote{16} took out full-page advertisements in the 1902 and 1903 trade press, boldly asking car builders: "DID IT EVER OCCUR TO YOU that you can save both time and money by getting our complete running gear...? DON'T WASTE YOUR TIME trying to build gasoline motors, when you can get them from us for less money than you can make them yourself." The firm also offered to equip their running gears with bodies, requiring the car maker only to label and sell the completed vehicle.\footnote{17} Figures 2, 3, and 4 show advertisements from suppliers of that era.

Other firms repeated Lindsay's sales pitch. Andrew Lee Dyke, owner of the Auto Supply Co., was an automobile pioneer who built St. Louis' first car in 1898, and who
DID IT EVER OCCUR TO YOU

that you can save both time and money by getting our complete running gear for Gasoline or Electric Automobiles with chain drive?

THINK IT OVER!

DON'T WASTE YOUR TIME

Triangulizing gasoline motors, when you can get them from us for less money than you can make them yourself.

WE GUARANTEE THEM TOO!

Lindsay Automobile Parts Co.

INDIANAPOLIS, INDIANA

WE MAKE GEARS.
WE DO GEAR CUTTING.

ANOTHER THING

we would like to call your attention to, is the fact that we make a running gear for Electric Automobiles with SPECIAL REAR AXLE to which the motor may be directly attached.

S.H.T. GASOLINE MOTOR

Figure 2. Advertisement for Lindsay running gears, motors, and axles for electric automobiles. Taken from Motor Age, Jan. 8, 1903, p. 29.
This is the Proposition
We Have to Make Manufacturers:

A complete gasoline run-about running gear, ready for the body, painting, trimming and tires. The only proposition in America of the kind. This is built with wood or wire wheels as may be desired and

Any Style Body can be used, also Any Wheel Base.

Either of these Gears can be Furnished, Finished Complete, with Body, if Desired

This is the Electric Running Gear We Make

Any desired style body can be attached, also any wheel base can be used. The motor is direct geared to the rear axle at right angles, and is attached to the middle of the axle, which centralizes the weight.

SEE US AT THE CHICAGO SHOW
Spaces 33 and 34 * * These Gears will be on Exhibition

Lindsay Automobile Parts Co.
INDIANAPOLIS, INDIANA

Figure 3. Advertisement for Lindsay running gears and completed cars. Taken from Motor Age, Feb. 12, 1903, inside back cover.
IT'S A CONDITION
NOT A THEORY
THAT CONFRONTS
THE MOTOR CAR MANUFACTURER

This Fine Road leads to Peace and Contentment.
* Follow it and you will be able to Deliver 1906 cars promptly to your agents exactly as promised.
* And this will mean more to you and the dealers next year than ever before.
* Need we say more?

This Rocky Road leads to Darkness and Disaster.
* To follow it means delayed completion of 1906 cars—late deliveries to agents—cancelled contracts—lost trouble ahead, resulting in the necessity of raising prices on your cars late in the season.

YOU CAN TAKE YOUR PICK

But—you better select the good road and write us quick—

DIAMOND STAMPED WARE CO.
RADIATORS DETROIT, MICHIGAN
Hoods (Horizontal or Vertical Tubes)
authored a popular series of repair manuals during the first two decades of the century. He abandoned car building in 1899 and foresaw "that the automobile supply business would become a distinct branch" of the industry. Although "there was at the time but a small demand" for auto parts, he was the "first in America" to dedicate his firm solely to supplying the emerging industry. Dyke, like Lindsay, produced complete running gears, "and from the way orders are being received it is safe to assume that there will be a hundred or two new automobiles in the country that were never inside a factory other than Dyke's." The Neustadt-Perry Co. of St. Louis conducted a similar business and marketed "designs of steam and gasoline carriages for which it makes complete sets of parts....The company will furnish the buyer with assembling blueprints." In the first years of the century, the prospective automobile builder needed only to purchase completed cars from Lindsay or Dyke, or kits from Neustadt-Perry. Few builders went to that extreme, but the option nevertheless existed.

The activities of Lindsay, Dyke, and Neustadt-Perry revealed the porous boundary between supplier and assembler. These firms were a bit of both, since they sold completed cars and kits but did not market the vehicles themselves. Other early entrepreneurs moved freely across this boundary. George Holley, for instance, gained a "considerable reputation" with his one-cylinder car, the Holley Motorette. But he gave up auto building to focus on carburetion, one of the critical design problems in early gasoline engines, and he became a leading manufacturer of carburetors by 1905. In 1902, Henry Leland made technical improvements in the engine which he supplied to the Olds Motor Works, boosting its output to 10.25 horsepower. Ransom Olds refused to accept the more powerful engine because it would have required radical changes in his car's design, thus prompting Leland to go into the automobile business for himself. Leland's Cadillac, the first mass-produced car with truly interchangeable parts, won fame for its excellent design and solid construction.
These early suppliers experienced two forms of competition. On the one hand they competed with rival parts firms for orders from many low-and mid-priced builders who outsourced major components. In this case, parts makers sold what Takahiro Fujimoto has termed “supplier proprietary parts,” components for which the supplier carried out almost all of the design, development, and manufacturing. As the experiences of George Holley and Henry Leland made clear, suppliers of this sort were important sources of innovation in the early industry. Parts makers and auto builders probably shared little engineering information, cooperating only as required to fit the components into the completed vehicle. It seems likely that Henry Leland and Ransom Olds maintained this type of relationship and failed to discuss key engineering issues. A closer collaboration between the two men might have led Leland to keep in mind the limitations of the Oldsmobile’s construction as he designed his improved engine; alternatively, Olds might have engineered his car with an eye toward future improvements.

Suppliers also competed with builders, usually high-priced luxury automakers, who often manufactured their own components. To secure business from firms like Cleveland’s Winton Motor Carriage Co, parts makers needed to convince them to buy their parts instead. In this case, suppliers provided what Fujimoto has called “black box parts,” components for which suppliers and assemblers shared many aspects of their design and development. Typically, the assembler was responsible for basic design parameters such as cost/performance tradeoffs and the integration of the part into the overall vehicle design. The supplier in turn designed the component to meet the automaker’s general requirements. Such collaboration required a rich flow of technical information and capital between parts maker and auto builder. Winton maintained this kind of relationship with the Cleveland Cap Screw Company, the forerunner of TRW Inc. Alexander Winton, like most other car makers at the turn of the
century, experienced difficulty in obtaining a valve which functioned effectively. As Frederick C. Crawford, a later president of TRW, reminisced fifty years later, Winton "had great trouble making valves....[T]he poppet valve is a lump on top of a stem. He screwed them on, and he riveted them on, and he cut them out of steel, but they didn't work...." In 1903, Charles Thompson, an engineer at Cleveland Cap Screw who later became president, invented an automobile valve in which a nickel-steel head was electrically welded to a carbon-steel stem: This production method resulted in a low-cost, high-performance, and reliable valve. Alexander Winton became the firm's first valve customer. Cleveland Cap Screw at this time lacked the machinery to produce all of the valves that Winton required, so Winton invested $25,000 to buy the necessary machinery to get his orders produced. Convinced of the success of the valve design and anxious to protect this vital source of supply, Winton secured majority ownership of Cleveland Cap Screw and became its president.

Fujimoto has identified a third type of component, "detail-controlled parts," parts for which the automaker retained responsibility for the part's entire design. In this case, the assembler treated suppliers "as nothing more than providers of production capacity," hiring them to produce components to detailed design drawings and manufacturing specifications. Little evidence of this type of component can be found from the first decade of commercial automobile production. Design drawings in this period probably required some interpretation and communication, and suppliers and assemblers often collaborated during the design and fabrication of important components.

Assemblers had relatively little power over their suppliers, especially during boom years and for components which required a measure of manufacturing skill. This arose from the fact that automobile parts orders accounted for a small proportion of business for most forges, foundries, and machine shops. In 1903, for instance, several
builders in the growing auto city of Toledo, Ohio faced the threat of production holdups due to delays in obtaining crucial forgings. Low-volume auto makers who placed small orders waited as long as sixty days for their shipments. The editor of *Motor Age* lamented, “The forge plants, busy with great orders for heavy work, turn a deaf ear to the demands of the automobile maker. Only such people as Olds and Winton, ordering from 800 to 3000 pieces from a single die, are worth catering to.” He found that Toledo factories “ready to ship dozens of vehicles are unable to ship one. With about 300 parts to be incorporated the maker believes himself practically ready when he discovers that part 236 is missing.” Such dependence upon tardy suppliers was not just “exasperating,” but threatened the solvency of many builders as well. “Customers must wait. Capital must remain tied up. Profits must decrease—perhaps to be totally absorbed.” The editor advised “the prospective manufacturer...to inquire carefully” into these “troubles experienced every day” by automobile builders.23

Automakers of this period depended upon their suppliers for more than just timely deliveries. Parts firms also provided vital financial support to many makers during their critical start-up years. Indeed, the majority of assemblers owed their survival to the supplier infrastructure. Lawrence Seltzer, an early historian of the industry, noted that parts makers assumed much of the fixed and working capital burdens in this period. Most makers entered the automobile business with little investment in fixed plant. Because they relied upon “the previous development...of standardized interchangeable parts manufacture,” all many automobile makers needed to do was “the assembling of the major components and the sale of the completed vehicle.” In short, the prospective automaker “required neither large plant nor elaborate equipment” as “specialized automobile factories...were not essential” for quantity production24 Most companies began business in rented quarters and with little specialized machinery.
Parts makers eased much of the working capital costs of the early automobile firms as well. Parts firms extended thirty to ninety day credit on orders, a much longer time than that required to assemble and sell the finished car. At the same time, most car builders required their dealers to advance cash deposits when placing orders and to pay in full upon delivery. Many suppliers also accepted stock for payment in lieu of cash. Thompson Products, the prominent maker of valves in this period, made it “common practice...to accept a customer's stock or other securities in liquidation of a delinquent account.”

Low entry barriers—minimal technical expertise, little fixed plant requirements, and favorable credit agreements—coupled with exploding demand, allowed over one hundred automakers to enter the industry by 1908. However, many of these firms were underequipped and unable to ride out economic downturns. Those auto companies which existed on “the thinnest of equities” failed during the depression of 1907; these failures only increased the “hostile conservatism” of bankers and shrunk the credit they extended to the rest of the industry. Looking back on 1907 and 1908, automobile pioneer Benjamin Briscoe recalled that easy entry into the industry encouraged “manufacturing gamblers,” speculators who “had adopted methods that were described as ‘plunging,’” to try their hand at automaking. These “piratical...‘skimmers’...did not have a worthy car or any manufacturing ability,” but succeeded at selling large amounts of watered stock with very little to back it. Briscoe acknowledged the pivotal role that parts suppliers had played in the auto industry’s early years, but he also blamed them for bringing a “great deal of discredit upon the industry” by “encouraging into the business underequipped concerns and inexperienced makers.”

Briscoe’s depiction of such “plungers” and “skimmers” applied to many firms selling in the lower and middle segments of the price spectrum that is, those producers
able to enter the market with little capital or technical ability. Luxury makers, on the other hand, assured prospective buyers of their financial stability and conservative management practices while proudly proclaiming their vehicle's technical superiority over lower-priced cars. Producing distinctive, individualized autos with craftsmanlike care, they asserted that assembling from outsourced components detracted from a vehicle's uniqueness and quality. A 1904 advertising brochure for Winton automobiles, for instance, took the prospective buyer on a mental tour of the factory floor to underscore the care and workmanship that went into every component. This account impressed upon the buyer that Winton made everything from its rough castings to its sumptuous upholstery, and it concluded by noting the patient care which went into the 30 to 36 labor hours of final assembly. 29 In a promotional piece from 1908, Alexander Winton said, "I believe that every maker ought to be personally responsible for the cars that leave his factory, and it gives me pleasure to assume that responsibility for Winton cars, because I know to the minutest detail of what they are made, and how they are made." 30

These pronouncements were a little exaggerated. As his relationship with Cleveland Cap Screw showed, Winton bought many parts from "specialists," but only those "in which he has absolute confidence." 31 In addition to buying all of his valves from Cleveland Cap Screw, Winton gave a Cleveland supplier of drop forgings a sole-source contract for 16,000 connecting rod ends and turn buckles in 1903. 32 The company's 1906 Model K used Holley carburetors, but returned to an in-house design a year later. 33 Winton selected suppliers with great care, and subjected their components to severe engineering and road tests before placing orders. 34

No automaker, then, was entirely self-sufficient: behind each stood a network of suppliers which provided components, technical innovations, and financial support. As consumer demand for automobiles grew, many automakers moved to safeguard their
sources of supply. By 1909, two strategies emerged: 1) vertical integration, the
acquisition of independent parts makers or the expansion of in-house components
production; and 2) reducing dependence on specific suppliers by promoting
standardization.

**Mass Production and Vertical Integration--1909-1920**

In many ways the automobile industry came of age in 1909. That year's sales of
128,000 passenger cars was twice that of 1908's output. Until 1920 annual sales
increased 30% or more, nearly doubling again in 1912 and 1916. In 1917 automobile
production reached about 1,750,000 cars despite America's involvement in World War
One and the shift to war production.\(^{35}\) 1909, and the few months bracketing it,
witnessed major reorganizations which soon led to the consolidation of market power in
the hands of a few automakers, especially Ford and General Motors. Within the next
ten years those two companies accounted respectively for one-half and one-fifth of
production volume.

These trends—exploding consumer demand and centralization of final market
power—affected relations between automakers and suppliers in two important ways.
First, automobile producers did not compete with each other so much for sales—there
was enough consumer demand to go around—as for raw materials and components,
chronically in short supply during this period. Second, the high-volume producers
began using their strong market positions, first to protect their sources of supply and
then to gain the upper hand in their dealings with suppliers. By 1920 the major
automakers had created a fiercely competitive parts industry which was largely at their
mercy.
Alfred Sloan recalled the common worry among automakers during his years as president of Hyatt Roller Bearing, that "lack of one tiny part might hold up [an] assembly line. That fear was the nightmare of the business." Builders who assembled their cars from outsourced components encountered such hold-ups more often than vertically integrated makers. Shortages of raw materials like steel were equally serious problems, especially after 1915, when American industry geared up for war production. The auto industry was unable to secure steel shipments while railroads, construction companies, and munitions plants which placed much larger orders got timely deliveries. Because parts makers consumed relatively small amounts of steel, they were forced to pay higher prices and to wait longer for deliveries than most other steel consumers. Many suppliers passed on these higher prices and longer lead times to their customers. As a result, an assembled car of this period cost about 20% more than a manufactured car of comparable quality and design.

Because of these difficulties in obtaining components and steel, the larger assemblers who could afford the fixed and working capital burdens began to produce more of their parts themselves. There existed two paths to vertical integration: expansion of the home factory, and the acquisition of independent parts makers. Henry Ford chose the first and William Durant chose the second alternative.

Late in 1908 Henry Ford unveiled his plans for his famous Model T. He sold over 10,000 of them in 1909, making him the largest automobile producer in the world. The economic and technological imperatives of "Fordism" necessitated centralized control over all phases of manufacturing, assembling, and selling. This strategy was enormously successful for about two decades, giving Ford undisputed dominance in the low-priced market segment and making him the world's largest automobile producer. The production and marketing inflexibilities of Ford's policy only became
apparent in the mid-1920s under pressure from more diversified makers like General Motors.

The reason usually given for Ford's vertical integration was his desire to attain greater economies of scale and scope, and so to reduce manufacturing costs. The logic of mass production of interchangeable parts required specialized machinery and a regimented division of labor. Ford extended such regimentation to his suppliers, "most of whom came to make a single component of the product." Many suppliers moved to Detroit to devote themselves exclusively to the growing automaker. Because many parts makers depended upon Ford orders for the bulk of their business, the company regarded them almost as wholly-owned subsidiaries. Ford "purchased materials for its components-makers, reorganized their manufacturing processes, supervised their larger policies, and, in some cases, aided them in financing production." From its opening in 1909, the River Rouge plant was "so dependent upon...its specialized suppliers that its own operations were frequently within thirty minutes of suspension because of tardy deliveries of parts or materials."³⁸

The John R. Keim Mills of Buffalo, New York was one such supplier. Since 1908, Keim had been Ford's major supplier of pressed steel parts for the body and chassis of the Model T. By 1910 when Ford, when Ford bought out the works, the automaker had largely quasi-internalized Keim. Ford not only sent production specialists to Buffalo to assist with mass-production techniques, but also invested heavily in machinery necessary to produce Ford's orders. The companies jointly developed a method for making pressed steel axle housings and crankcases. According to historian John B. Rae, by 1910 the automaker "was so deeply involved" in the Keim organization "that it was simpler to buy the organization outright" instead of financing its further expansion to meet Ford's orders.³⁹ Ford secured the plant for $570,000, "a bargain with or without the Keim Mills and their machinery," since he
acquired the management expertise of William Knudsen, who went on to direct the expansion of Ford’s assembly-line methods; W. H. Smith, an expert in deploying machine tools for mass production; and John R. Lee, later the head of the notorious Sociological Department.40 After a strike in 1912, Ford moved to assure his supply of these important components. He moved the machinery and key managers to Detroit and integrated them into his plant’s daily operations; he left the troublesome work force back in Buffalo.

When Ford opened its new Highland Park plant in 1914, the company moved to bring almost all components production in-house. Writing in the late 1920s, the economist Lawrence Seltzer found that this vertical integration was a gradual process, “for the Company needed the resources of its suppliers to sustain the volume of its output.” Ford slowly took over components production “because parts-manufacture was so lucrative, and because supervision of independent concerns under the purchase system proved difficult.” Ford understood the logic and techniques of mass production, and plowed his profits into specialized tooling and material handling equipment. The cost savings which resulted from Ford’s strategy were impressive, and the components which Ford took in-house ranged from bolts to transmissions formerly provided by the Dodge brothers.41 Historian John Rae has also claimed that Henry Ford sought self-sufficiency “partly because he believed it made for greater economy and efficiency but also partly because he just disliked being dependent on anyone else.”42

At about the same time that Henry Ford introduced the Model T, William C. Durant was consolidating several automobile builders and parts firms into the General Motors Company. He pursued a different route to vertical integration, that of decentralized divisions run as separate profit centers. Under this arrangement,
General Motors produced several lines of cars and owned many captive parts subsidiaries.

While Ford retained tight control over all phases of his far-flung operations, Durant envisioned General Motors as a loosely bound collection of auto companies and supporting parts firms.43 Whereas Ford sought to mass-produce only one model and to increase sales by reducing price, Durant hedged his bets by acquiring companies with radically different designs. He recalled, "I was for getting every kind of car in sight, playing safe all along the line."44 GM’s organization chart reflected Durant’s shotgun approach; by 1910, the company owned controlling interest in twelve automobile manufacturers and about a dozen parts firms.

Durant saw the importance of acquiring parts subsidiaries because GM’s automobile divisions assembled their vehicles and depended to a great extent upon their outside suppliers. He was well aware of the industry’s chronic difficulties in obtaining components and steel, and he felt it imperative to safeguard important sources of supply in this business climate. The parts firms he acquired made components such as axles, transmissions, engines, bodies, ignition systems, lamps, and rims.45

By late 1910 Durant’s program of aggressive expansion had overextended the financial resources of the company. General Motors owed banks about $2,700,000 and other creditors between $4,000,000, and $5,000,000. In November a banking syndicate gained control of GM, promising “a reorganization of the management,” removing Durant from all decisionmaking; and “a restriction of enthusiasm,” ceasing all acquisitions of the sort which had led to this crisis.46 Shunted aside at GM, Durant obtained control of the newly-formed Chevrolet Motor Company in 1913. Chevrolet was instantly successful and sold nearly 16,000 vehicles in its first two years. Durant
took his share of the profits and began buying General Motors stock in early 1915. By late fall, he and his allies owned enough stock to regain control. He once again embarked on a policy of expansion, forming in May 1916 the United Motors Corporation as a wholly-owned parts subsidiary of GM. Durant saw United Motors partly as a good investment but mainly as a way to ensure GM's sources of supply. As with the parts companies which Durant had bought when he was president of GM before 1910, the nine subsidiaries which made up United Motors produced components which were not widely available on the arms-length market: ignition and lighting systems, ball and roller bearings, horns, differential gears, radiators, wire wheels, and demountable rims.

While Ford and General Motors dominated the low- and mid-priced markets between 1909 and 1920, room remained for dozens of smaller firms. Smaller makers experienced the same pressures on their supply bases, but they were forced to pursue different strategies. Each maker's market position--its production volume and its price class--helped shape its dealings with suppliers.

Luxury builders like Winton also were heavily integrated, but for a different reason. While the mass producers needed assured sources of supply to prevent production hold-ups, luxury producers made their own parts because they marketed their cars as unique and distinctive. In 1913 Alexander Winton claimed that he could "easily quadruple" his output by reducing the price of his six-cylinder model from $3250 to $2500. But he chose not to, since "it would be necessary for us to cut down quality, to skimp on workmanship, or, worse still, to assemble parts from other factories, instead of building the car ourselves....Winton Six merit is individual and exclusive."\(^{47}\) In another advertisement Winton boldly announced that "the production of automobiles by the assembling method is basically wrong...[T]he assembler is controlled by the
parts maker; the principal is ruled by the subordinate....[T]he assembler is a parts manufacturer’s selling agent, a mere middleman, an economic intruder."

Winton’s pronouncements led potential customers to believe that he fabricated almost everything entering into his car. While he did produce the majority of his components, he still relied on a supplier network for items like bearings, axles, carburetors, and ignition and lighting systems. Perhaps the key difference between Winton and mid-priced assemblers was the care he took in choosing his components and the firms supplying them. The firm’s engineering records between 1910 and 1914 show that Winton engineers put prospective components through a battery of harsh tests in the shop and on the road, tests in which the supplier’s chief engineer often participated. In May and June 1914 Winton personnel subjected a Delco lighting and ignition unit to three weeks of factory and road tests, culminating in a three-day road test between the Delco plant in Dayton, Ohio and the Winton factory in Cleveland. Charles Kettering accompanied the Winton people for about thirty miles and returned to Dayton, but a second Delco engineer made the entire trip to Cleveland. Later in that year, three Winton owners returned their cars to the Detroit dealership with problems in their Bosch ignition and lighting systems. As a result of their complaints, two Bosch engineers, including their chief engineer, spent a day assisting the Winton men in identifying the trouble.

Most automakers were neither luxury builders nor high-volume producers. Unlike Winton, these firms outsourced most of their components; unlike Ford and General Motors they could bring little final-market power to bear on parts makers. For them, cooperative relations with suppliers were imperative. Standardization of components by the Society of Automobile Engineers (S.A.E.) was the main strategy by which the smaller makers obtained smooth working relationships with their suppliers. Howard Coffin, vice president of Hudson Motor Car, launched the standardization
program during his term as president of the S.A.E in 1910. These standards placed automobile making on a more rational footing, cutting back, for example, the number of sizes of lock washers from 800 to 16 and types of steel tubing from 1600 to 210. Before standardization, a firm wishing to change its supplier of carburetors or spark plugs often needed to redesign its engine to do so. But as John Rae has noted, standardization "was more than a matter of technical convenience; it was of critical business importance to the small manufacturers who were dependent on outside supplying firms for their parts." Before standardization, an automaker found it difficult to find another source of supply if a key supplier went out of business; conversely, suppliers were left with thousands of dollars in unusable inventory if one of its customers failed. Because standardization held clear benefits for smaller firms like Hudson, they "were the most ardent supporters" of standardization while the "big firms were inclined to stand aloof." 

Reflecting on four years of S.A.E. standardization, W. G. Wall, Chief Engineer of the National Motor Vehicle Co., found that it was "easier and cheaper" to buy standardized parts, and that "time of delivery is very materially shortened, which often prevents costly and wasteful delays." The chief engineers of Lozier, Woods, and Waverly all agreed with Wall. D. Ferguson of Pierce-Arrow also found that standardization helped his firm to obtain proper grades of steel and aluminum. Before standardization, Pierce-Arrow wrote its own metallurgical specifications. As these often conflicted with those of the steel mills and foundries, "endless correspondence resulted, [and] frequently a compromise had to be accepted, as few of the large producers cared to cater to individual requirements unless the tonnage involved was very great." When mills "consented" to take special orders, "they charged excessively" and delivered so far behind schedule that Pierce-Arrow could often "get more prompt shipments from the foreign houses." Moreover, "most of the drop forge
companies had never heard of heat treatment." With widespread recognition of the S.A.E. standards for raw materials, Pierce-Arrow's requirements were "supplied promptly by a dozen different houses."52

Parts makers supplying these smaller firms also benefitted from standardization. In early 1906, E. W. Lewis, sales manager for the Timken Roller Bearing Co., hoped that "the day will soon come when there will be some standardization of axle sizes and type of construction, so that it might be possible to get out more than two axles alike."53 Eight years later H. W. Alden, the company's chief engineer, found that "the adoption of the S.A.E. has been of very considerable benefit to us....While it is a difficult matter to figure out in dollars and cents the actual savings..., it is very easy to notice the saving in confusion and complication of parts going through the plant."54

While all suppliers who sold to several auto companies benefitted in a similar manner, Timken's product line gave it several advantages over most other parts makers. Timken produced axles and tapered roller bearings, specialized components which required skilled laborers, special alloys, and specialized machinery. These requirements placed their manufacture out of the reach of all except the very largest automakers. The integral place of Timken's products in the automobile meant that a car builder could not have switched to another supplier without redesigning the vehicle.

Timken engineers therefore worked closely with their customer's engineers, especially during the design phase of a vehicle's development. Timken's advertisements continually stressed its engineering skill and its close technical ties to its customers; one piece told the prospective automobile owner that "Timken axles in your car, no matter what its size or price, were selected and installed only after many conferences between Timken engineers and the engineers of the car builder."55 In 1917 the company told automakers that they could not include Timken axles "merely to
furnish a selling point; they must be built in—not tagged on.” Timken refused “to deliver motor-car axles except on definite assurance from the car builder that the car on the street will carry out the promise of the car on paper.” To assure that the finished vehicle matched its design drawings, Timken “insist[ed] upon knowing” the weight of the car, the size and output of the engine, the chassis’ weight distribution, and “all other details of construction which in the slightest degree” affected how the axles functioned as integral parts of the completed car.⁵⁶

It is inconceivable today for a parts firm to review assembly drawings before agreeing to supply an automaker. That Timken could do so before 1920 brings out some interesting implications. Obviously Timken brought to bear a great deal of technical knowledge in its relations with its clients. Since Timken insisted on checking designs, the firm evidently placed little trust in the engineering abilities of some of its customers. In this case, suppliers like Timken, rather than automakers, stood at the locus of technical innovation. Timken took responsibility for the axle’s design, but its incorporation into the finished vehicle required much exchange of technical information between supplier and builder.

Another advantage which Timken enjoyed was its diversified customer base. In 1910 Timken-Detroit Axle sold to 35 automobile manufacturers and 30 truck makers; only one, Cadillac, was a high-volume maker. In that same year, Timken Roller Bearing sold to 86 automakers, 41 truck companies, 8 transmission builders, and several rail car and heavy equipment manufacturers. This large customer list ensured that its fortunes were not tied to the fates of one or two makers and helped the firm to retain its status as an independent supplier.

The history of Hyatt Roller Bearing Company, a New Jersey firm producing a part much like Timken’s, had a different outcome. Until 1916 Hyatt had been riding the
crest of the auto industry’s phenomenal growth and had expanded its works to meet automakers’ massive demand for bearings. As Alfred Sloan later recalled in his autobiography, the firm sold to about fifteen auto companies; however, Ford made up the majority of Hyatt’s business, with General Motors accounting for most of the remainder. “Suppose,” Sloan worried, “one or the other or both decided to make their own bearings? The Hyatt Roller Bearing Company might find itself with a plant far bigger than it could use and nowhere to go for new business.” Realizing that this placed the firm in a “desperate situation,” Sloan realized that he could not much longer “remain in the same status of apparent independence.” He rejected affiliation with Ford, seeing “no way to place the business under the wing” of the giant company while retaining a scrap of autonomy. So, when Durant proposed buying out Hyatt, Sloan was more than ready to listen.\textsuperscript{57} Hyatt Roller Bearing Company became a division of Durant’s United Motors Corporation in 1916.

Control of key patents also helped many parts firms to retain their independence. The Steel Products Company, a forerunner to today’s TRW, owned a cluster of patents which gave it a virtual monopoly on the manufacture of welded automobile components. These patents ensured that over 90% of all valves—except those in Ford cars, which used a different design—were purchased from Steel Products. As the firm’s president Charles Thompson recounted in the early 1930s, “[T]he entire valve business enjoyed by the Steel Products Company” in 1916 “was attributable to the ownership of patents and patent rights, and to that alone.”\textsuperscript{58}

But patent rights did not guarantee their owner an exclusive business. In 1914 Schwppe and Wilt, a Detroit manufacturing firm, obtained a patent on the manufacture of drag links, an electrically welded component used in the steering mechanism. As TRW President Frederick Crawford recalled, Schwppe and Wilt “had no alternative but to grant some licenses under its process.” Already by 1916, “it had become
almost standard practice among the automobile companies to insist that a supplier of automobile parts make available to them additional sources of supply” in order to avoid “a complete tie-up of the automobile companies’ production.” Because of its monopoly on drag links, Schweppe and Wilt fell into “great disrepute with purchasing agents” and its relations with its customers “were becoming more and more strained.” In early 1917, Schweppe and Wilt licensed Steel Products and another company to make drag links under its patent, but it kept for itself the lion’s share of the business, and only “outwardly met the objections of the automobile companies.”

In 1919 the automakers discovered that Schweppe and Wilt had been fixing its licensees’ prices and production volumes, a practice which its customers bitterly protested. Instead of providing more liberal licensing arrangements to other parts firms, the Detroit company attempted to reassert its monopoly. It served notice to automobile manufacturers who bought drag links from other suppliers that they were liable for damages by reason of their failure to buy from Schweppe and Wilt. Buick, “at that time one of the principal customers” of Steel Products, was one of the auto companies notified. Buick peremptorily told Steel Products to resolve the infringement controversy otherwise “it would be compelled to transfer its business elsewhere.” Seeking to avoid legal entanglements and the loss of an important customer, Steel Products ended the issue in April 1920 by buying out Schweppe and Wilt “at an exorbitant price solely in order to acquire that company’s drag link patents.” Because Schweppe and Wilt’s actions had so infuriated the automobile industry, Steel Products “inherited ill will to such a degree that it was confronted with a real problem among its customers.”

Industry Consolidation After 1920
By 1920 the automobile industry had gained enough control over its supplier base to demand that key parts makers share proprietary technology, such as basic patents, with customers and competitors alike. Such a demand was unthinkable in 1909. Two trends during these twelve years, the industry’s fast growth and its consolidation in the hands of high-volume producers, had shifted market power from suppliers to automakers. What began around 1909 as a series of defensive moves to avoid production hold-ups became by 1920 an aggressive and successful attempt to create a subordinate parts industry. In order to preserve their final-product market rents, the large automakers refashioned the components industry into two sectors: captive subsidiaries who produced specialized parts, and financially independent firms who competed fiercely for commodity parts orders. Automobile manufacturers after 1920 dealt with their outside suppliers at arm’s length, awarding them short-term contracts on the basis of price. Automakers increasingly required suppliers to produce components according to the automakers’ blueprints, leaving little room for suppliers’ innovations.

By 1920 the accelerating trends toward increased centralization and vertical integration had become apparent. Even though about eighty firms produced passenger cars in commercial quantities, Ford and General Motors produced respectively one-half and one-fifth of the industry’s volume. Barriers to entry were rising. As one observer noted, “The day is past when a concern with a few hundred thousand dollars can undertake the manufacture of a $1500 car....The low priced cars are practically all in the hands of a few big manufacturers.” By this time industry consolidation had all but eliminated “the possibilities of the lower-priced assembled products of 4 and 5 years ago.” Only the medium and high price segments remained for the smaller firms.62

Smaller producers were already at a significant price disadvantage compared with their high-volume counterparts. This handicap became telling during the recession
of 1920 and 1921. Until 1920 demand had increased steadily, often spectacularly, from year to year, but toward the end of that year demand suddenly slumped. Except for the war year of 1918, 1921's production of about 1.5 million cars was the lowest in six years. As John Rae has noted, the recession caught many of these smaller manufacturers "badly overextended." Even General Motors teetered on the edge of insolvency. This downturn forced over fifty smaller builders into bankruptcy between 1922 and 1926.

The large automakers stayed afloat by cutting prices and passing the cuts along to their suppliers. When Henry Ford slashed his prices in late 1920, he demanded deep reductions, in some cases 35% to 40%, from his suppliers. Those firms unwilling to grant these concessions suddenly found their contracts cancelled. The editor of Automotive Industries blasted builders like Ford in November 1920 for regarding a parts order "merely as a memorandum of intent" subject to cancellation "according to the drift of the trade." While builders were justified in seeking price reductions from their suppliers, they should still have given parts firms "a hearing as to whether they can reduce their prices without a loss." Concluded the editor, "Whatever may be the legality of a sales contract, it implies a moral obligation not to destroy the other party to it, if that can be avoided.”

Although demand picked up after 1922, the number of manufacturers continued to fall. Production reached almost four million passenger cars in 1926, but only 44 automobile producers remained in business. In that year the "Big Three" (Ford, General Motors, and the recently formed Chrysler) held 75% of the market. The five largest "Independents" (Hudson, Nash, Packard, Studebaker, and Willys-Overland) held three-quarters of the remaining 25%. That left roughly 6% of the automobile market to the smallest 36 firms. Automobile production peaked at about 5.5 million cars in 1929, but the Great Depression hit the industry hard; production declined to 1.3
million in 1932, the lowest volume since 1915. When demand picked up in the late 1930s, only eight firms remained; by 1939 the “Big Three” accounted for 90% of the market and the five surviving “Independents” fought over the last 10%.

The firms which survived the 1920s and the 1930s deployed their final market power to strengthen and to extend their control over the parts industry. The interwar years made permanent the trends in supplier relations begun between 1909 and 1920. While the degree of vertical integration rose and fell with demand conditions, automobile companies would revise their adversarial relations with their outside suppliers only when their market shares eroded.

**Conclusion: ‘Japanese-Style’ Supplier Relations?**

Several examples of quasi-internal relationships between assemblers and suppliers existed in the early American auto industry. Ford established a supplier network between 1909 and 1914 in which specialized parts firms shipped their orders “just-in-time.” The giant automaker took equity positions in many of its parts firms, and provided capital and expertise to reorganize their manufacturing operations. The Keim Mills in Buffalo was one such supplier. Similarly, General Motors owned a controlling interest in Fisher Body Corporation for several years, only buying it outright in 1926. During the 1910s and 1920s, the large makers moved away from quasi-internalization and toward a mixture of vertical integration and arms length (and often adversarial) relations with outside suppliers. They did so for two reasons. Acquisition of independent parts firms acted to block competitors’ access to key sources of components. Automakers also employed competitive, short-term, price-based bidding to increase and to preserve their share of final-product market rents, usually at the expense of their outside suppliers.
The Japanese auto industry between 1955 and 1970 experienced the same dramatic explosion in demand that the US industry did from 1909 to 1920. But Japanese assemblers chose to strengthen rather than abandon their quasi-internal ties to their suppliers. Some of this divergence is due to historical and cultural factors; Japan industrialized later and under much different circumstances than did the United States. American anti-trust legislation and business culture placed limits on interfirm cooperation, while Japanese law and business culture encouraged it.

But economics played a role as well. Most importantly, quasi-internalization assisted Japanese assemblers in overcoming the perennial capital shortage in the auto industry of the 1950s. Although the Japanese industry grew quickly, neither Toyota nor Nissan could match the booming sales that gave Henry Ford the power to buy out the Keim Mills and the Dodge Brothers, and to build the massive River Rouge plant. Japanese firms were also unable to raise capital through the stock or bond markets, as did Durant and the DuPonts at General Motors. Using external suppliers gave the industry more access to capital than vertical integration would have, because it brought in more informal sources of funds. By the time automakers were able to generate significant amounts of internal funds, they had already developed skills and attitudes necessary to manage a system of “governance by trust;” the benefits of vertical integration were correspondingly reduced.

The degree of industry consolidation also shaped the different forms of supplier relations chosen by American and Japanese automakers. While the Big Three (Ford, GM, and Chrysler) have dominated the US market since the 1920s, ten Japanese automakers today produce a combined output only slightly larger than the total US production. The high level of concentration in the US produced correspondingly high profit margins, giving the Big Three an incentive to avoid sharing their profits with suppliers, even at the cost of overall reductions in social efficiency. Therefore, the Big
Three created a competitive market for automotive inputs, because the increased profits the automakers received due to suppliers’ low margins outweighed the disadvantages of reduced supplier investment and quality levels. The Japanese industry has relied on business groups (customer and suppliers tied together by partial equity ownership) and on keiretsu (long-term trading relationships not cemented with equity ties). The early American industry had important similarities to this pattern. Customers and suppliers often entered into long-term relationships involving close consultation and some degree of exclusivity. But important differences existed as well. Whereas Japanese subcontractors are often referred to as “children” of the “parent” automakers, in the early American industry this dependency was reversed. Suppliers provided automakers in the first decade of this century with capital, proprietary knowledge, and technical assistance. In this view, the current trend toward more cooperative supplier relations in the US auto industry seems like a return to this earlier pattern.

To some commentators, Japanese business groups and keiretsu promote technical and economic development while safeguarding industry stability. Others see them as unfair and restrictive, as barriers which prevent new firms from entering an industry. Early US automaking seems to have combined the best of both a keiretsu and a competitive market. Fledgling car builders drew upon the financial strength of their suppliers through long-term trading relations; conversely, suppliers such as Hyatt had enough assured demand to invest in fixed capital like specialized machinery and research laboratories. Such close collaboration fueled innovation, as it allowed both sides to solve technical problems and to improve the product’s quality. But these ties were fluid enough to preserve many of the benefits of a competitive marketplace. Automakers profited from their suppliers’ technical expertise gained in other industries
such as carriage-building and bicycle parts, and entry into the industry, either as supplier or assembler, was relatively easy.

After 1920, the industry increasingly combined the worst features of keiretsu and competitive markets.69 Vertical integration gave the automakers stability but removed incentives for dynamism. Outside suppliers lacked the capital to make the investments necessary for innovation. Moreover, automakers lowered the barriers to entry into the parts business by taking design and engineering functions in-house and by requiring suppliers to deliver piece parts rather than subassemblies. These practices led to severe problems in uniting product and process.70

1 The authors wish to thank John Grabowski of the Western Reserve Historical Society for his invaluable help with manuscript sources and Ken Hirano for his incisive comments on an earlier draft of this paper.


4 For a discussion of quasi-internalization of parts suppliers in the Japanese motor vehicle industry, see Masahiro Shimotani’s piece in this volume, “The History and Structure of Business Groups in Japan.”


7 "Manufacture in New England," *Motor Age* 1, No. 1, Sept. 12, 1899, pp. 4-5


9 The Olds Motor Works made 1400 cars priced at $650 each in 1900, accounting for about 35% of all US production. See Seltzer, pp. 19 and 75.


11 Ibid., p. 107.


14 "Another Builder in Michigan," *Motor Age* 2, No. 9, Aug. 28, 1902, p. 21.

A running gear was essentially an underframe and steering mechanism but did not include an engine or transmission.

*Motor Age*, Jan. 8, 1903, p. 29 and Feb. 12, 1903, inside back cover. Capitals in original advertisement.

"Two of Neustadt's Latest Outfits," *Motor Age* 1, No. 26, June 26, 1902, p. 12.


19 Ibid.

22 Fujimoto, op. cit., pp. 3-4.

23 "Automobile Production in Toledo," *Motor Age*, III, No. 12, March 19, 1903, p. 13

24 Seltzer, pp. 19-20.

25 Ibid., pp. 20-1.

26 Frank K. Dossett, "Physical and Economic History: Highlights, 1895-1955," typed manuscript, 1955, p. 76. TRW Inc. Records, MSS 3942, Western Reserve Historical Society, Container 21, Histories and Indexes. In Feb. 1933, for instance, the Board of
Directors advised the management to sell 291 shares of the struggling Marmon Motor Company's stock, valued at about $3000, "at whaterver price the officers were able to obtain."

27Seltzer, p. 31


32"Hussey Progress," The Motor Age IV, No. 7, Aug. 13, 1903, p. 14

33"Winton Model K: An American Motor Car of Exceptional Merit," Cleveland, The Winton Motor Carriage Co., 1906, sales brochure found in the 1906 Winton Marque File; and advertisement for Winton Type XIV, Country Life In America , April 1907, p. 696, found in the 1907 Winton Marque File.

34"Engineering Data and Laboratory Records, Engineering Dept., The Winton Motor Car. Co.," 1910-1914 gives details of these tests. Winton Marque Files, Western Reserve Historical Society.


Seltzer, op. cit., p. 100.


Rae, op. cit., p. 107.

Ibid., pp. 100-101.

Ibid., p. 106.

For a thorough treatment of the financial history of General Motors during this period, including Durant's ouster in 1910 and his resumption of control in 1916, see Seltzer, chapter IV.

William C. Durant, as quoted in Seltzer, p. 157.

See Seltzer, p. 154 for a list of Durant's holdings at the end of 1910.

Ibid., p. 162.

"Big Output or Big Merit?", *The Auto Era* XII, No. 12, Aug. 1913, pp. 3-4. Italics in original.


"Engineering Data and Laboratory Records," Engineering Dept., The Winton Motor Car Co, Cleveland, Ohio, 1910-1914, pp. 618-24 and 647-8; Winton Marque Files, Western Reserve Historical Society, Cleveland, Ohio.

Epstein, op. cit., pp. 41 and 184.


54 "Makers Save by Using S.A.E. Standards," op. cit.


56 "Does the Car Agree with the Blue Prints?" advertisement in *The Auto Era* XVI, No. 12, Aug. 1917, inside back cover.

57 Sloan with Sparks, op. cit., pp. 86 and 93-4.


60 Tax Return Notes; Container 2; folder 4, 1919-1920 Tax Return Memos; TRW Collection.

61 "Affidavit of Frederick C. Crawford," op. cit.


63 Rae, op. cit., p. 136.

"Contracts and Prices," *Automotive Industries* XXXIII, No. 21, Nov. 18, 1920, pp. 1034.


Even when innovations were available, powerful automakers chose not to use them. For example, Henry Ford refused to make engine blocks for his Model A out of aluminum because he did not wish to deal with Alcoa, a monopoly supplier.
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